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| 10/614,618      | 07/07/2003  | Kedar Sharadchandra Namjoshi |                     | 7483             |

7590 10/31/2007  
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| EXAMINER |
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VU, TUAN A

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2193

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10/31/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/614,618

Applicant(s)

NAMJOSHI, KEDAR  
SHARADCHANDRA

Examiner

Tuan A. Vu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 August 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. This action is responsive to the Applicant's Appeal Brief filed 8/14/07.

As indicated in Applicant's response, no claims have been amended. Claims 1-26 are pending in the office action.

In view of the Applicant's remarks in light of the state of the latest Office Action and the prior art of record, prosecution of the case is herein RE-OPENED as set forth in the Office Action herein included, taking under reconsiderations all observations made from the above Appeal Brief.

### ***Specification***

2. The attempt to incorporate subject matter into this application 'by reference' to alleviate in-depth re-exhibiting some formula or finite state expressions via mentioning of Non-Patent literature document(s) (see previous Office Action) is ineffective because these appear to be non-essential (as confirmed in the Appeal Brief from above). Moreover, because of the complex nature of symbolism involved in understanding the expressions therein, these 'incorporated by reference' material, which require undue analysis and possibly extraneous reading, has not deemed very supportive for understanding the *metes and bounds* of the instant invention in light of the prior art. It is urged that Applicant provide, whenever possible, the necessary hardcopy of these NPL documents, should said material pertinent have some effect in helping the Examiner to better interpret and understand what is novel in the invention as disclosed.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 1-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps and indefiniteness in relationship of the claimed elements are set forth as follows.

Claim 1 recites 'forming a product ...'; obtaining an abstract domain ... possible states ... abstract relations'; 'computing an abstract program with a reduced number of states and an altered version of said branching ... property f..., using said product'. The claim presents a context of reducing with preserving of branching property, but one of ordinary skill in the art would not be able to learn: (i) what is actually expressed as an automaton A; and (ii) whether the abstract program being computed is the result from combining reduced number of states and an altered version of one branch property f, OR this computed program yields reduced number of states and an altered version of a property.

Regarding (i), there is teaching in the Specifications, that based on a property f, some states and transitions are set when the program M is submitted into an automaton as a cross product; but when the claim language entails that a single property is expressed by the multitude of possibilities on a automaton, the language of the claim is indefinite or not reflective of what is disclosed.

Regarding (ii), it is observed that:

(a) If the altered version of a property f is the end result , then the intended purpose of *preserving* property f is not clear; further, if the end result is a combination of 'reduced number

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of states and altered version of ...  $f'$  then, how the *number of states* being reduced and *altered version of  $f$*  being suddenly contextually involved is not justified, i.e. antecedent basis for both becoming an impropriety, especially when the *computing* step is using the 'product', NOT 'the abstract domain'.

(b) Alternately, if the computing step by way of the 'product' ( $M, f$ , by  $A$ ) is utilizing both the reduced number states and a altered version of  $f$ , then one of ordinary skill would not know how the 'reduced number' of states have been achieved from the 'forming' step and 'obtaining' step, lacking structural connection or intermediate steps otherwise deemed essential to: bring about a number of states being reduced; or interrelate the elements in the 'abstract domain' step with the 'computing' step to support the 'reduced' and 'altered' limitations.

To interpret the claim, the Specifications is scanned (pg. 6, li. 13 to pg. 10, li. 20, as set forth in the Appeal Brief, pg. 6), and the above indicated part of the Specifications teaches:

An abstraction method starting from forming  $ATS\ M\ X\ A$ , based on branching time  $f$ , all of which supported by a document (namely, "Abstract Transition Relation Using Ranking Functions and Choice Predicates", whose copy is not provided, which Applicant characterizes as non-essential material incorporated by reference (see Appeal Brief, pg 5, top); the abstraction of the real program into states and transitions by way of sets in an abstract domain; wherein a model checking based on steps of Figure 2 (product  $M$  with property  $f$ ) is introduced) is instrumental and operates based on establishing abstracted states of the abstract domain. Further, the Specifications mentions about requirement of successor states in regard to AND and OR transitions using  $R'$  and  $L'$  labeling; wherein flexibility in defining  $R'$  and exactness of calculations can be exploited to achieve completeness, thus avoiding explicit construction of

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MxA (bottom of pg. 7). It is evident that a series of theorems and proofs have to be imparted based on establishing of requirements or modifications of conditions from the abstraction of M X A of the outset in order to reach a point of proving whether some values or set of states in the 'abstract domain' satisfies a transition or proposition; or the set of states would satisfy a predicate; thus alleviating the full expansion of a M X A product, which could be resource prohibitive. That is, the reduction concept revolves around developing a abstracted program based on simulating of alternatives as to enforcing some requirement to the states and the transitions therefrom via propositions and predicates in a way to be able to perform induction proving for soundness or completeness based on proposed theorems or propositions, whereby preserving transition labeling, implying thereby that the number needed to fully deploy MXA is alleviated.

The elements as organized in the claim do not get full support from the above teachings, because the amount of information from the above entails more than just forming a product, obtaining an *abstract domain* and 'computing a abstract program with the reduced states and a 'altered property version of f' using the product. For example, the claim (even in light of the Specifications) does not make it explicit and simply clear that AND and OR transitions include branching time property expressed as specific sets whose states -- which are created in the *abstract domain* which is not involved in the 'computing' step -- are labeled and subsequently preserved if soundness is justified based on modification of the ATS via restriction using predicate, ranking or choice; that is, essential steps or structural interrelationship are lacking in the claim. Nor is there any consistency in utilizing the very phrase 'branching time property f' and an alteration thereof in the course of establishing theorem (Specs, pg. 8-9) along with the

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proposed sets of invariant or temporary states, so that when all soundness is achieved, *f* being intermediately 'altered as a version *f*' would enable or support some implied (if not explicit) reduction of a *number of states*, when this is not directly tied to the 'abstract domain' as claimed.

In short, essential steps are lacking in the claim in order to enable one of ordinary skill in the art to see how reduction of the number of states has been achieved in order for this reduction to support (computing ... with a reduced number of states) computational result such as a abstract program, i.e. computation based on the 'obtaining' or the 'product' forming step, notwithstanding the indefiniteness in terms of how an abstract domain (in the obtaining step) being obtained is absent from the computing step, when the number of states is implicated and when only the abstract domain contains possible states.

As mentioned in (a), the intended purpose of program *M* for preserving *f* is not clear; and one would not be able to see how reduction has taking place when no alteration of said property has been introduced, lacking tight relationship between the *number* of states and the abstract *values* and *relations* recited earlier; and lacking a correspondence between *abstract domain* and the 'computing' step.

Broad interpretation of the claim based on the proof approach in the Specifications will be used to examine the merits of the claim. Accordingly, 'preserves' as claimed will be treated as the combined effect of 'forming', 'obtaining' and 'computing' in light of the scenario a above; and 'reduced states' will be treated as restriction to the possibilities of numerous transitions with applying some criteria, or conditions to satisfy.

Claims 2-13 do not remedy to the indefiniteness of claim 1, hence are rejected.

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Claim 14 is also rejected for reciting the same steps and insufficient relationship among these steps as set forth above.

Claims 15-26 are also rejected for the same reasons.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-4, 12-17, 25-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Ben-Ari et al, “the Temporal Logic of Branching Time”, *Acta Information 20*, 6, pg. 207-226, 1983 (hereinafter BenAri).

As per claim 1, BenAri discloses a method for reducing a program, M, that preserves (Note: induction proof for a proposition or proposed rules to completeness checking reads on keeping the branch temporal formula based on provability of proposed transitions – sec 5, pg. 220) at least one branching time property, f, comprising the steps of:

forming a product of said program, M and said branching time property, f, e.g. *program P, automata, branching time... temporal framework* – middle pg. 208) expressed as an automaton A (e.g. *finite model property, UB... all possible combinations* – bottom, pg. 208 Note: Unified UB of branching time reads on product to express branching time property for a program with all possible combinations, i.e. expressed as automaton – see *nondeterministic, all paths* - pg. 209, top);



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obtaining an abstract domain containing a set of abstract values to generalize possible states of said program and abstract relations that relate said program states to said abstract domain (e.g. states, paths, binary relation - sec 2, pg. 209, bottom; Semantics for *UB*, pg. 210);

computing an abstract program with a reduced number of states (Note: formulation of induction proof via formula, axiom, theorem and lemma using rank and marking reads on eliminating of paths, i.e. number of deterministic and non-deterministic states - in the *UB* model – see pg. 209-224) and an altered version of said branching time property *f* (e.g. *proposition, rules, structure H ... iff* - pg. 212-214) using said product ( e.g. pg. 210, top; *is satisfiable... rules of inference ...complete axiomatization*, pg. 211, top).

**As per claims 2-3**, BenAri discloses performing an automated program check (e.g. proof – pg. 214-224; *Completeness*, sec 5, pg. 220 ); wherein said automated program check is a model checking step ( e.g. *model*- pg. 210, bottom; *limit our models*, pg. 211, bottom; *satisfiability ...prove ... finite model* – pg. 213 bottom; *any model ... Hintikka structure* – pg. 214, bottom).

**As per claim 4**, BenAri discloses wherein said automated program check is performed for an altered branching time property (branching time – pg. 208, bottom).

**As per claims 12-13**, BenAri discloses the step of obtaining one or more rank functions and employing (*ranking algorithm*, pg 217-218) said one or more rank functions in an abstract transition relation, *R'*; the step of obtaining one or more choice predicates (e.g. *W1, W2 ... alternative node ... our choices* – pg. 218, bottom to pg. 219, top) and employing said one or more rank functions in an abstract transition relation, *R'*.

As per claim 14, BenAri discloses a system for reducing a program, M, that preserves at least one branching time property, f, comprising: a memory; and a processor operatively coupled to said memory, said processor configured to:

form a product of said program M and said branching time property, expressed as an automaton A;

obtain an abstract domain containing a set of abstract values to generalize possible states of said program and abstract relations that relate said program states to said abstract domain;

compute an abstract program with a reduced number of states and an altered version of said branching time property using said product;

all of which limitations having been addressed in claim 1 above.

As per claims 15-17, and 25-26, these claims correspond to the subject matter of claims 2-4, and 12-13, respectively, hence will incorporate the rejections as set forth therein.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 5-7, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ben-Ari et al, "the Temporal Logic of Branching Time".

As per claim 5, BenAri does not explicitly disclose defining a set of states, S', in said abstract program as  $S' = \{\text{overscore}(S)\} \times Q$ , where S is a set of states in said program, M, and Q is a finite set of states of the automaton A; but according to BenAri disclosing a unified UB

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branching system whereby a program M is abstracted into a multitude of represented paths and states (refer to claim 1; *finite* model - pg. 208, bottom; pg. 210, bottom) the cross product concept using a automaton is disclosed, and the abstract program M with S states and Q the automaton represented *finite* states is also strongly suggested. It would have been obvious for one skill in the art at the time the invention was made to implement BenAri cross product of program M and the above automaton via the UB system so that S' would be a cross product from the set of states in said program M and the finite set of states in said automaton used in said UB system, because this would enable for each such S' set, applying axioms, proposition using lemma, theorem to inductively prove validity (re claim 1) of some formula or tableau concerning a branching temporal behavior for such S' product, based on BenAri's purpose ( see pg. 224) for unifying not only deterministic states (finite state) but also non-deterministic via model checking for completeness against each proposition.

As per claim 6, BenAri does not disclose wherein OR states in said set of states, S', are those states where  $\delta(q, true)$  has the form  $q1 \vee q2$ , and all other states are AND states, where q are individual states and  $\delta$  is a transition relation between states. But transitions expressed in finite state machines technologies as perceived via BenAri using operators to represent an OR or AND type of operations (V or V-inverse) of  $\delta$  transaction to yield a states and to equate this operation in terms of it being true or false was a known concept (see pg. 211-212). In light of possibilities of transitions in a program which mostly include either OR or AND type of path (based on the operators V or V-inverse or  $\cap$  ), as exemplified by BenAri, it would have been obvious for one skill in the art at the time the invention was made to provide symbolism as

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represented by the branching time temporal abstracted system by BenAri so that OR transitions has  $q_1 \vee q_2$  format and AND operations has the other transition formats.

As per claim 7, Alur does not explicitly disclose wherein an abstract state  $(t, q^\wedge)$  is in a subset of initial states,  $I'$ , of the abstract program if there exists  $s \in I$  for which  $s \cdot \xi(q^\wedge) \cdot t$ , where  $s$  is an individual state,  $I$  is a subset of initial states,  $I$ , of the program,  $M$ , and  $\xi(q^\wedge)$  is one of said abstract relations. The concept of subset among a superset in view of the automaton-based establishing of axiom, theorem, or lemma is strongly conveyed from BenAri propositions using theorems expressed with  $\in$  (see pg. 214; pg. 215). Based on the cross product of the program  $M$  by an branching time logic represented by UB system using an automaton, it would have been obvious for one skill in the art at the time the invention was made to implement the unified system by BenAri so that subset  $s$  belonging to subset  $I$  initial states is abstracted via  $\xi(q^\wedge)$  transition to yield a subset state --abstract state  $(t, q^\wedge)$ -- belonging to a superset  $I'$  of said abstract program; because this is how the transitions and states according to BenAri theorem, proposed tableau -- which includes  $\in$  operators --can be validated and checked for completeness (see pg. 212-224)

As per claims 18-20, refer to the rationale of claims 5-7, respectively.

*Allowable Subject Matter*

9. Claims 8-9, in conjunction with claims 10-11, respectively, **contain** allowable subject matter but are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, pending resolution of the subject matter being rejected that involve, in part, these base claims.

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10. Likewise, claims 21-22, in conjunction with claims 23-24, contain allowable subject matter that would be allowable if rephrased and represented in the independent claims, pending resolution of the corresponding rejection set forth therein.

***Response to Arguments***

11. Applicant's arguments with respect to rejection set forth in the previous Office action have been considered but are moot in view of the new ground(s) of rejection.

***Interview Summary***

12. As initiated by the Examiner, Applicant's representative and Examiner had a telephonic discussion, as per 10/24/07; and according to which, the Examiner presented some proposed changes to the independent claims, which would include some teachings from specific dependent claims to address the reduced number of states as claimed, thereby possibly enable some distinct patentable weight to have facilitating effect over how to prosecute the case. But based on time constraints and short notice character of the proposals, no agreement was reached.

***Conclusion***

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan A Vu whose telephone number is (571) 272-3735. The examiner can normally be reached on 8AM-4:30PM/Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai An can be reached on (571)272-3756.


The fax phone number for the organization where this application or proceeding is assigned is (571) 273-3735 ( for non-official correspondence - please consult Examiner before

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using) or 571-273-8300 ( for official correspondence) or redirected to customer service at 571-272-3609.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tuan A Vu  
Patent Examiner,  
Art Unit 2193  
October 26, 2007